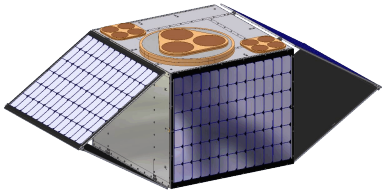


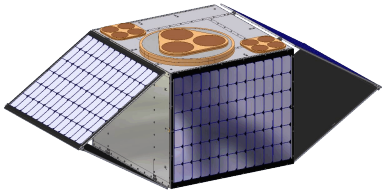
AMSAT Eagle Project
Fall 2004 Status Report

Presented by
Richard M. Hambly, W2GPS

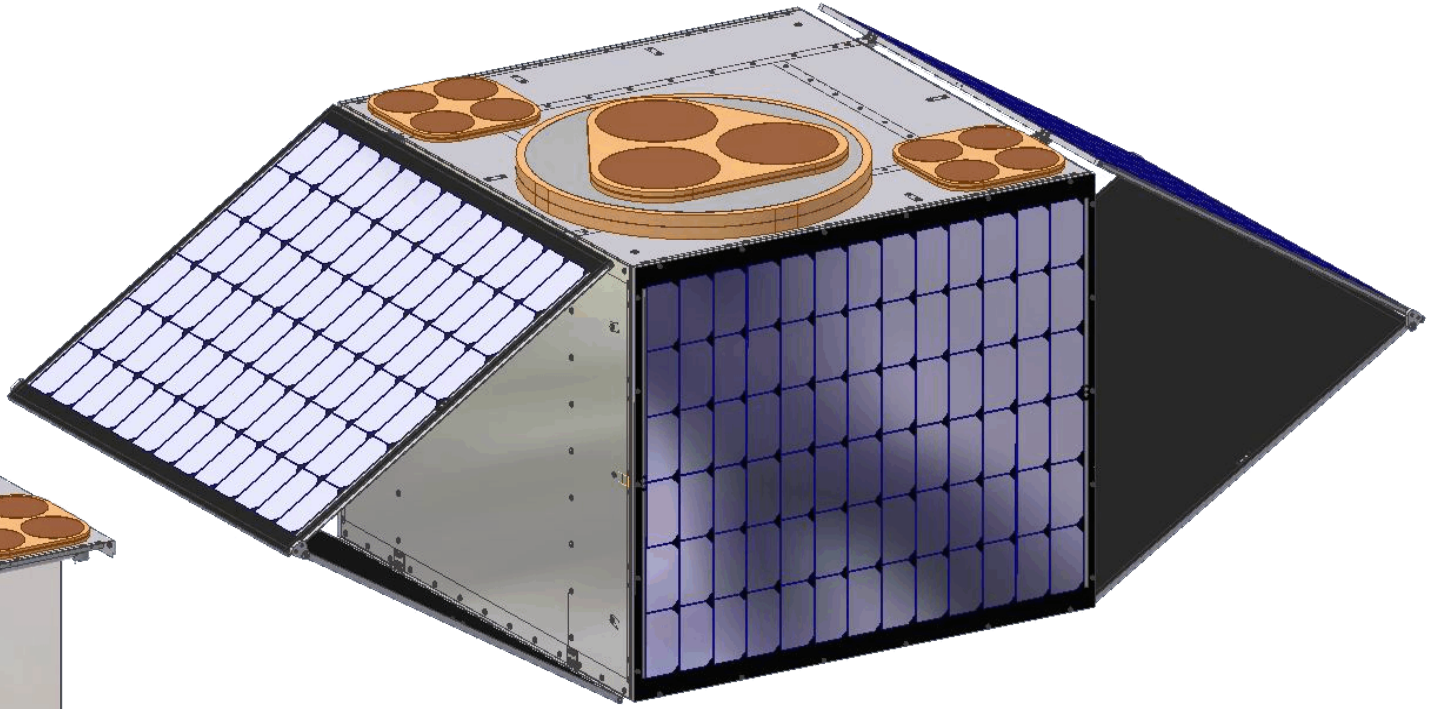
2004 AMSAT Space Symposium

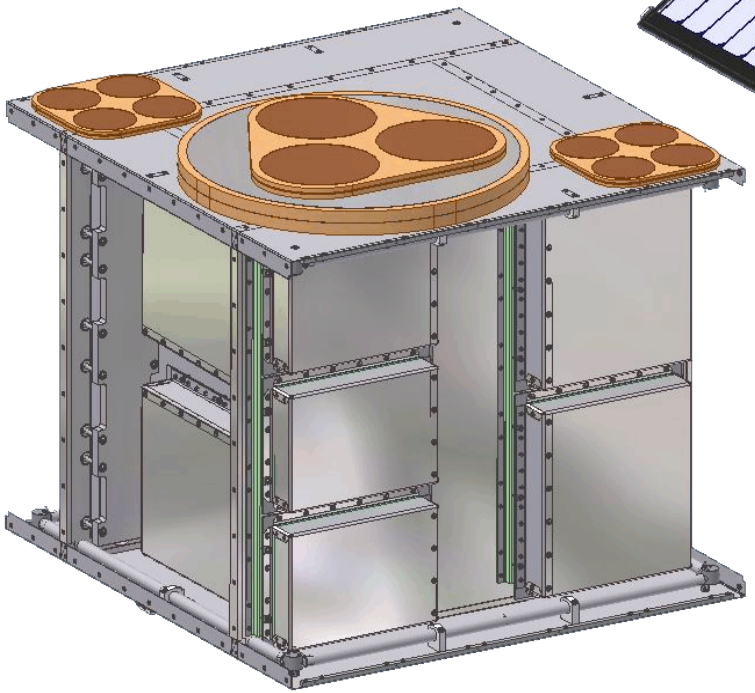
Friday, October 8, 2004
Crowne Plaza Hotel, Arlington, Virginia

AMSAT's Current Design Project



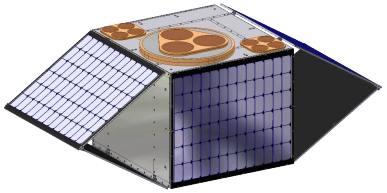
Eagle!

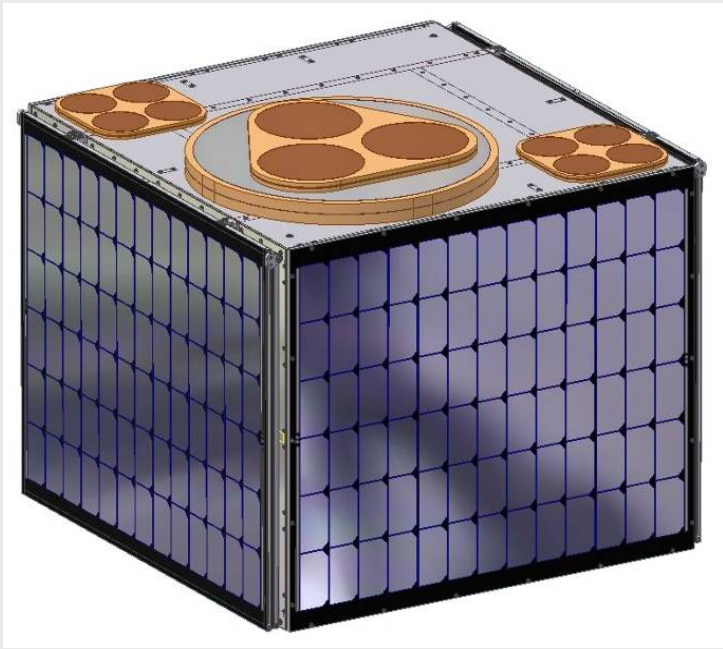




- 6 cu ft, ~50Kg
- High Elliptical Orbit
- 80+ Watt power budget

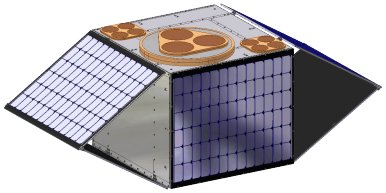
Eagle and the Strategic Plan





AMSAT is a non-profit volunteer organization which designs, builds and operates experimental satellites and promotes space education. We work in partnership with government, industry, educational institutions and fellow amateur radio societies. We encourage technical and scientific innovation, and promote the training and development of skilled satellite and ground system designers and operators.

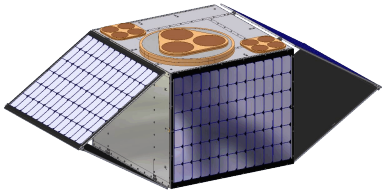
Eagle and AMSAT's Vision



Our Vision is to deploy high earth orbit satellite systems that offer daily coverage by 2009 and continuous coverage by 2012. AMSAT will continue active participation in human space missions and support a stream of LEO satellites developed in cooperation with the educational community and other amateur satellite groups

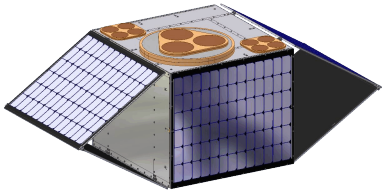
Tom Clark W3IWI, Gerald Youngblood AC5OG and Bruce Paige KK5DO working on AMSAT's Strategic Plan.

Eagle's History



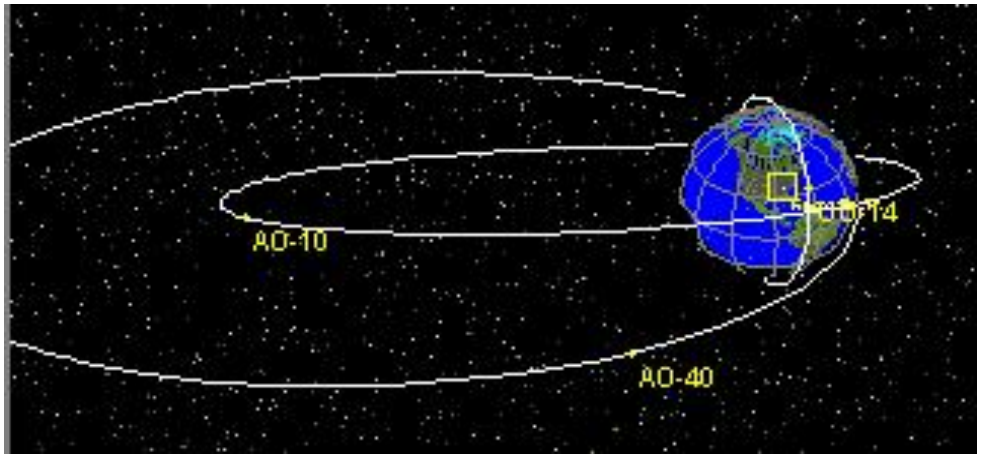
- "So You Want to Build a Satellite" by Dick Jansson WD4FAB presented at AMSAT's 18th Space Symposium in Portland Maine on Oct 28, 2000.
- Project Committee met July 14, 2001 in Denver, Colorado.
- Eagle Design Team met Sep 28, 2002 in Orlando FL.
- Eagle Design Team met the weekend of Jul 17, 2004 in Orlando FL.
  - » Mechanical/Thermal design work has been done by Dick Jansson, WD4FAB over the past several years
  - » A Requirements Specification outline was developed and key design parameters were chosen.
  - » Team leadership assignments were made.

Eagle's Specifications
1.0 Payloads



1.1 Transmitters

- V band 20KHz bandwidth using SDR techniques
- Two S Band
  - 100KHz bandwidth
  - Either transmitter can be driven by SDR or analog inputs
- C band wideband digital which includes telemetry
- All bands should be capable of being operated simultaneously

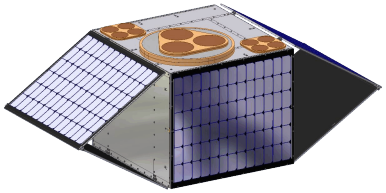


HEO Orbit

1.2 Receivers

- U band 100KHz bandwidth
- L band 100KHz bandwidth
- C band wideband digital

Eagle's Specifications
1.0 Payloads

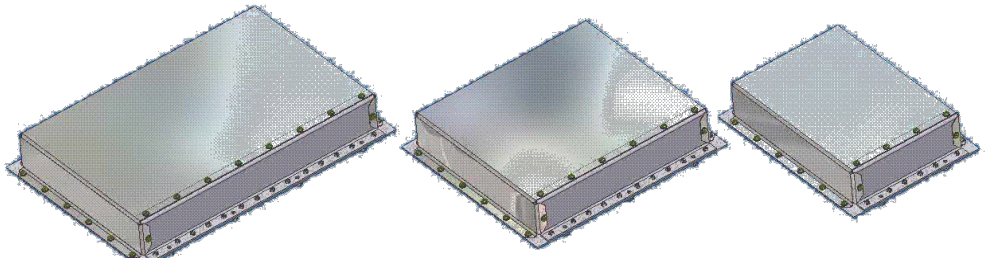


1.3 GPS (NASA)

1.4 CEDEX (Surrey Satellite Technology)

1.5 Cameras

- Narrow FOV on +Z axis
- Wide FOV on –Z axis
- Cameras should survive all beta angles.



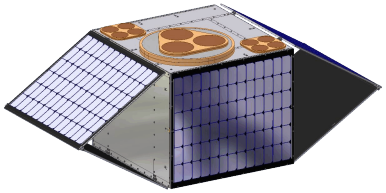
1.6 Telemetry beacons active on all transmitters

- The IHU will provide digital data and clock to the transmitter. The transmitter itself is responsible for data delivery.

1.7 Command uplinks on the U and L receivers

- Demodulation to baseband audio is in the receiver

Eagle's Specifications
2.0 Structure and Physical Properties



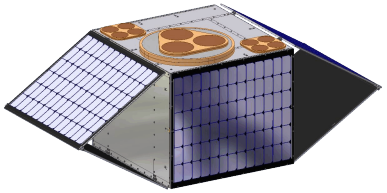
2.1 Mass
- 100Kg or less

2.2 Size
- 600mm by 600mm by 450 mm with fixed and deployable solar panels.

2.3 Stabilization
- Spin stabilized (+ Z Nadir pointing at apogee) 1-15RPM

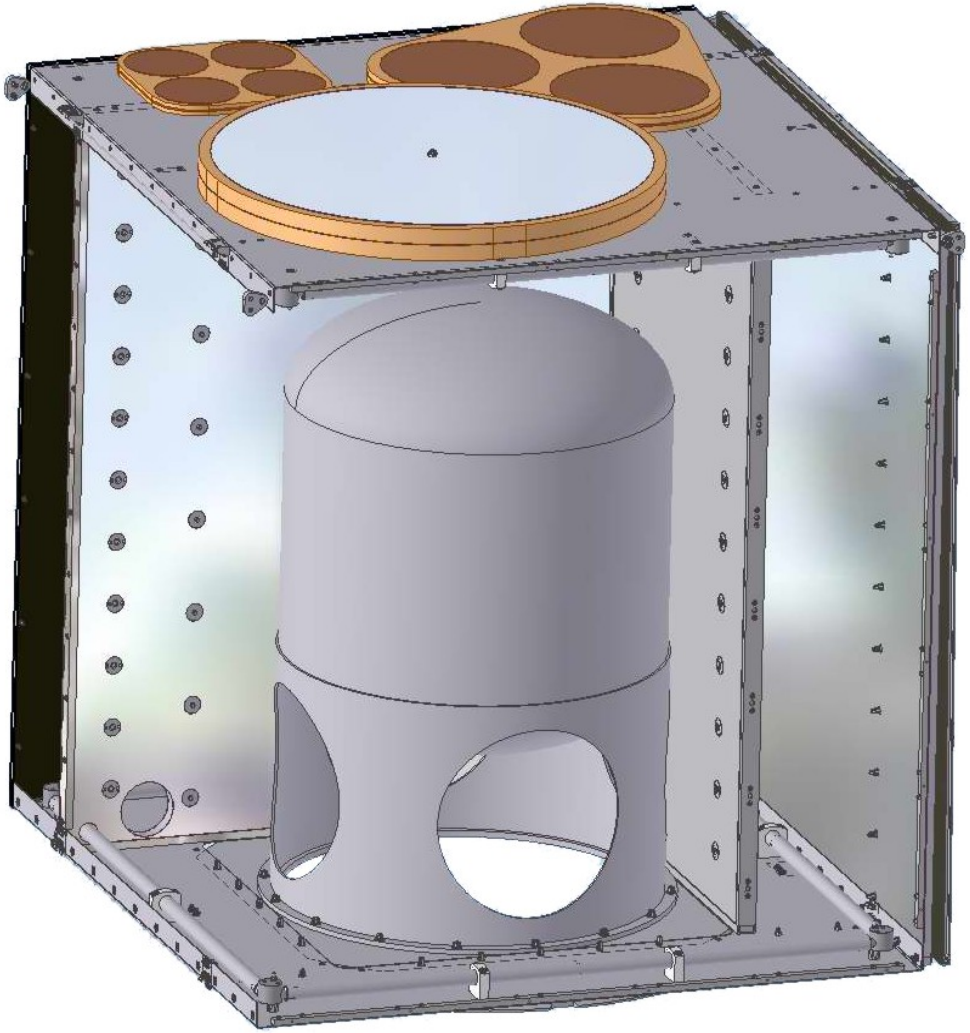
2.4 Orbit
- High apogee elliptical

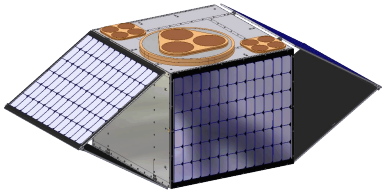
2.5 Attitude Control
- Magnetorquers and nutation dampers
- Sensors
  - The Sun sensors will measure the sun at all angles and attitudes
  - The Earth sensor will measure the attitude of the spacecraft with respect to the Earth while its distance is within two radii of the Earth's surface.
- The satellite will stabilize to the desired attitude in 72 hours.



2.6 Propulsion

- The simplest system that will accomplish a desirable orbit and is acceptable to the launch agency. Initial estimate is 60 meters per second delta velocity.
- The propulsion system should be modular





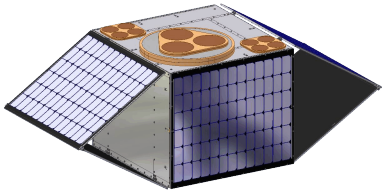
2.7 Structure

- Aluminum honeycomb panels forming core structure supporting internal modules and integrated with separation interface.

2.8 Magnetic Environment

- Magnetically clean as practically achievable

Eagle's Specifications
Thermal Control, Power Generation and Housekeeping

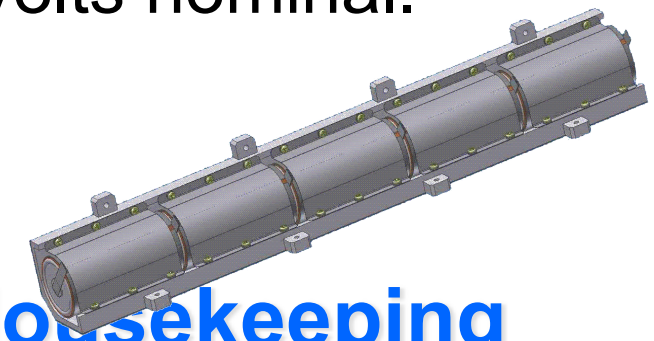


3.0 Thermal Control

- Battery temperature should not exceed a -15 to +15C range.
- Electronics module environment should be from -25 to +40C

4.0 Power Generation

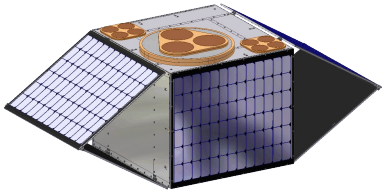
- Two fixed and four deployable solar panels with omni coverage.
- Fault tolerant BCR and battery system that fails in an operational mode.
- Buss voltage is 10 to 14 volts nominal.



5.0 Housekeeping

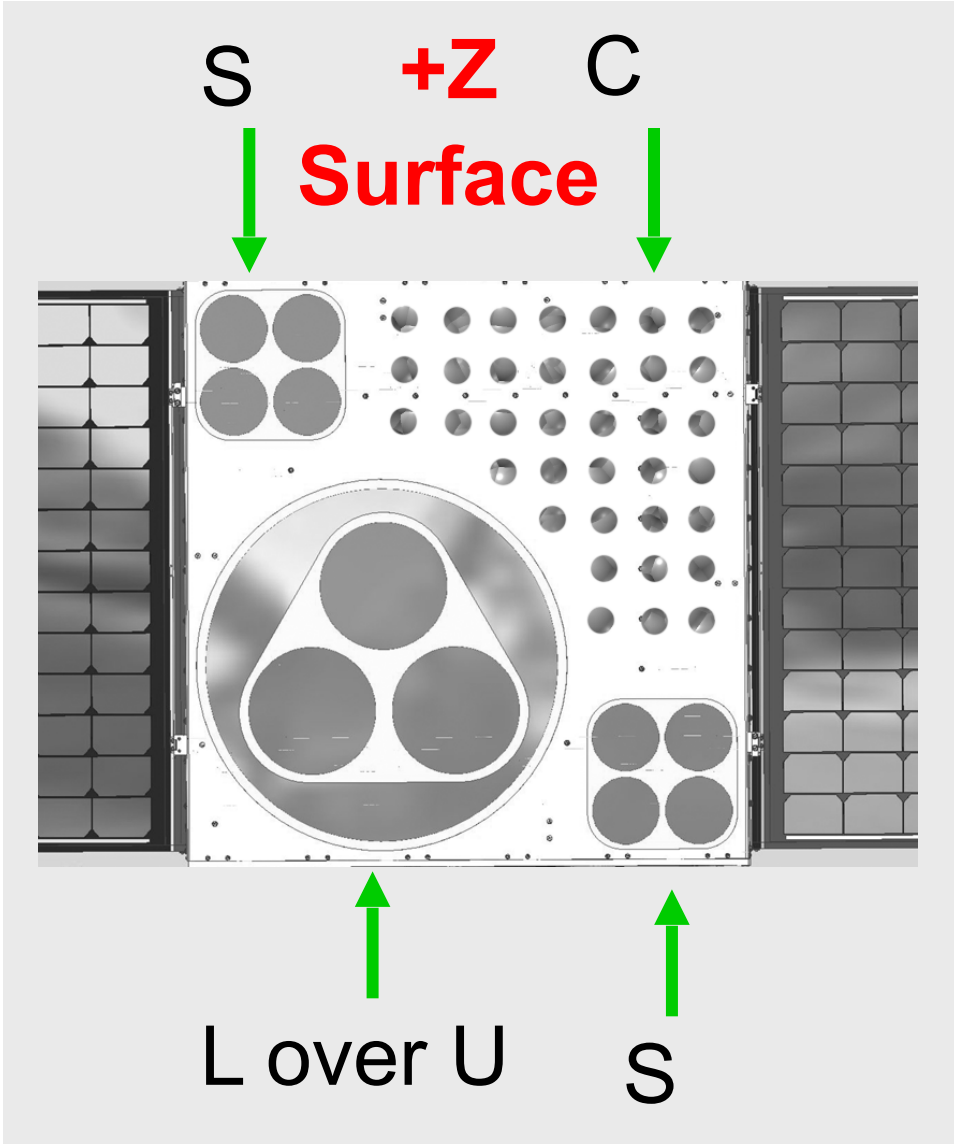
- IHU-3
- CAN-Do! Information buss

Eagle's Specifications
Housekeeping and Antennas

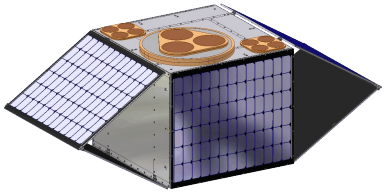


6.0 Antennas

- High Gain +Z
  - U (435MHz), L (1.2GHz), S (2.4GHz) and C (5.6GHz)
- Omni Antennas, -Z (functional in all attitudes)
  - V (145MHz), U, L and S
- Omni Antennas +Z
  - U, L and S



Eagle Team Leadership Assignments



Project Manager: Jim Sanford WB4GCS

Chief Technical Officer: Rick Hambly W2GPS (acting)

Secretary: Stephen Diggs W4EPI

Structure and Thermal: Dick Jansson WD4FAB

Launch: Lee McLamb KU4OS (lead), Tom Clark W3IWI (Russian launches)

Guidance and Control: Ken Ernandes N2WWD

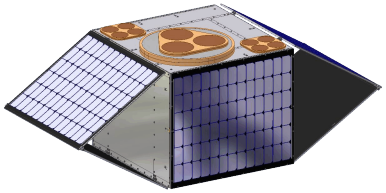
Sensors: Alan Bloom N1AL

Power Generation and Distribution: Lou McFadin W5DID

Propulsion: Stan Wood WA4NFY (lead), Daniel Schultz N8FGV, Ken Ernandes N2WWD

Antennas: Stan Wood WA4NFY

Eagle Team Leadership Assignments



Housekeeping: Bdale Garbee KB0G (data interface), Chuck Green N0ADI, Lyle Johnson KK7P (IHU-3)

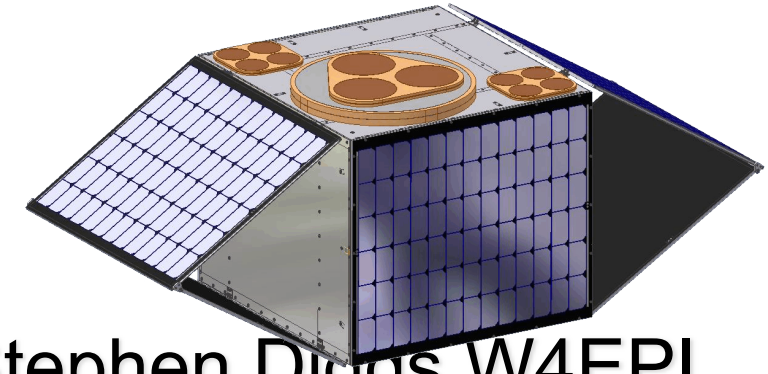
Antennas: Stan Wood WA4NFY

Payloads: Bob McGwier N4HY, Tom Clark W3IWI, Daniel Schultz N8FGV

GPS: Lou McFadin W5DID

CEDEX: Robin Haighton VE3FRH

Cameras: Gunther Meisse W8GSM

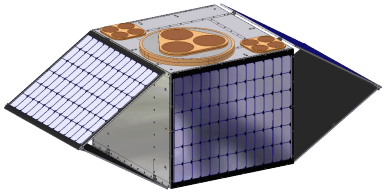


Command and Control/Telemetry: Stephen Diggs W4EPI, Stacy Mills W4SM

Radiation Environment: Steve Bible N7HPR

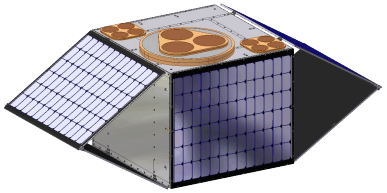
End of Life Issues: Larry Kayser VA3LK (SK 10/5/04)

Eagle – What's Next?



- What are the Next Steps?
  - » Design Team to review and solicit comments on the specifications
  - » BOD reviews design and cost estimates
  - » Fundraising is a critical component
  - » Critical subsystems must begin design work now.
  - » Find a suitable launch (Hopefully sooner than 2009)

AMSAT Needs Your Help!



- Eagle from the User's perspective
  - » Review the specification (see the article in the Proceedings).
  - » Volunteers are needed for key leadership and design positions.
  - » AMSAT needs your financial support
- Our ability to proceed with Eagle is directly dependent upon how quickly funds are donated for the project
- Questions?